

## Pollution Prevention (P2) for Data Centers

Data centers are the backbone of the digital economy. They house the servers and data storage devices that are responsible for the operation of technology firms. Data centers consume a **significant** amount of energy, approximately 2% of electricity used in the United States, due to the demand for constant power supply, air conditioning, and ventilation. The energy consumption of data centers is responsible for producing large amounts of greenhouse gas emissions. Data centers also produce a **great deal** of electronic waste due to the constant advancements in server and data storage technology.<sup>1</sup>



### Cooling and Air Flow Management<sup>2, 3</sup>

Minimize air flow obstructions by instituting a cable management program that removes abandoned or inoperable cables. This will increase the efficiency of air delivery. Prevent mixing of hot aisle/cold aisle air flow. Seal all cable, floor, and ceiling openings to isolate air paths. Use plastic refrigeration covers to seal space between tops of racks and air return locations. This improves isolation, but also allows for accessibility to the equipment for maintenance.

### Temperature Control<sup>2, 4 and 5</sup>

When using an overhead cooling system, use outlets that direct airflow down from the ceiling in front of the racks above the cold aisle. Raise the temperature of the cold air. IT equipment manufacturers recommend that data center operators can safely raise their cold aisle to 80°F or higher.

Use thermal modeling to locate hot spots and better understand airflow in the data center. This will allow for the proper placement of computer room air conditioners (CRAC's).

Use water as an energy efficient way to cool hot air. A high-efficiency VFD equipped chiller with an appropriate condenser water reset is typically the most efficient cooling option for large facilities. In cooler climates, use outside air and water to cool data centers.

### IT Opportunities<sup>6, 7</sup>

According to Energy Star, "server virtualization offers a way to consolidate servers by allowing you to run multiple different workloads on one physical host server." By implementing virtualization, the facility can repurpose and decommission servers while reducing electricity consumption costs. One of the most important benefits of virtualization is the ability to improve disaster recovery efforts since virtual servers can restart applications faster than physical ones.

Other IT opportunities include finding:

- More efficient power supplies
- Latest operating systems
- Advanced power management features
- Consolidating storage drives
- Efficient uninterruptible power supplies
- Best practices for using less storage like data compression, snapshots and tiering storage

### Energy Conservation and Efficiency

Through Energy Star, data centers can benchmark their performance and track their energy efficiency over time by comparing their facility to other data centers, estimating their carbon footprint and tracking and reporting progress.<sup>8</sup> Data centers can also purchase energy efficient data servers, identify drivers of energy costs such as their HVAC systems and conduct an energy audit.

Data centers can take advantage of combined heat and power (CHP), known as cogeneration. KPMG is an example of a data center that is capturing heat to keep their server rooms cool.<sup>9</sup>

The Center of Expertise for Energy Efficiency in Data Centers (CoE) has excellent information on how to increase energy efficiency in data centers as well as useful tools and trainings to assist companies in the process of increasing energy efficiency.<sup>10</sup>

Finally, consider purchasing renewable and clean energy sources to mitigate greenhouse gas emissions and match consumption for data center operations.

## Google Case Study <sup>11</sup>

Google has one of the largest, yet greenest data center infrastructures amongst the world's companies. In the past ten years Google has invested in the research and development of energy efficient green data centers, setting the bar for sustainable data center infrastructure. Among many sustainable activities, Google has invested in energy-proportional servers that reduce energy consumption by 25% and uses thermal modeling to better understand airflow in their data centers. The company uses water cooling systems and evaporative cooling systems at most of their data centers while taking advantage of sea water in respective regions. Finally the company continually reduces their data center waste by repurposing outdated servers and reusing their parts for other applications.

## General P2 Tips

Use local vendors for heavier and bulkier components. Buying local materials can help you reduce shipping costs and the carbon footprint of transportation associated with longer distances.

Prior to purchasing new equipment and materials, reuse what is already in your company's inventory. Removing and reusing components of old servers that are still in good working condition are actions that can be taken to reduce waste at the source. Resell components that can't be used and break down components that can't be sold into raw materials for responsible recycling.

The responsible use and disposal of electronics is important to mitigating waste in data centers. The EPA has generated guidelines for the sustainable management of electronics.<sup>12</sup>

See ADEQ's resource summary *Reducing Waste at the Source with Electronics* for information on selecting sustainable electronics and identifying certified electronic recyclers when disposing and recycling of electronics.<sup>13</sup>



## References

- <sup>1</sup> [Robertson, Chris and Romm, Joseph. The Center for Energy and Climate Solutions. \*Data Centers, Power, and Pollution: Prevention Design for Business and Environmental Advantage.\*](#)
- <sup>2</sup> [U.S. Department of Energy. \*Best Practices Guide for Energy-Efficient Data Center Design.\*](#)
- <sup>3</sup> [CoE. \*Master List of Energy Efficiency Actions.\*](#)
- <sup>4</sup> [Google. \*Data Centers. Temperature Control.\*](#)
- <sup>5</sup> [Google. \*Data Centers. Water and Cooling.\*](#)
- <sup>6</sup> [Energy Star. \*12 Ways to Save Energy in Data Centers and Server Rooms.\*](#)
- <sup>7</sup> [PG&E. \*Data Center Best Practices Guide - Energy efficiency solutions for high-performance data centers.\*](#)
- <sup>8</sup> [Energy Star. \*Benchmark Your Data Center's Energy Efficiency.\*](#)
- <sup>9</sup> [National Geographic. \*KPMG Captures Heat for Data Center Cooling.\*](#)
- <sup>10</sup> [Center of Expertise for Energy Efficiency in Data Centers.](#)
- <sup>11</sup> [Google. \*Data Centers.\*](#)
- <sup>12</sup> [EPA. \*Sustainable Management of Electronics.\*](#)
- <sup>13</sup> [ADEQ. \*Reducing Waste at the Source with Electronics.\*](#)

## Additional Resources

[National Institutes of Health. \*National Institutes of Health Sustainable Data Center Design Guide.\*](#)  
[U.S. Department of Energy. \*Data Centers and Servers.\*](#)

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